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US 4389793

US 3869798

US 3758958

US 4144652

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G1X

Selected US specifications from IPC sub-class G01B

## (54) Wheel alignment apparatus

(57) The apparatus comprises a wheel clamp for each wheel of a vehicle the clamp being readily fitted by a hook member 102 slidable in a slot 104, and adjustable to tyre width. Following attachment of clamps to the wheels, alignment means are fitted to the clamps.

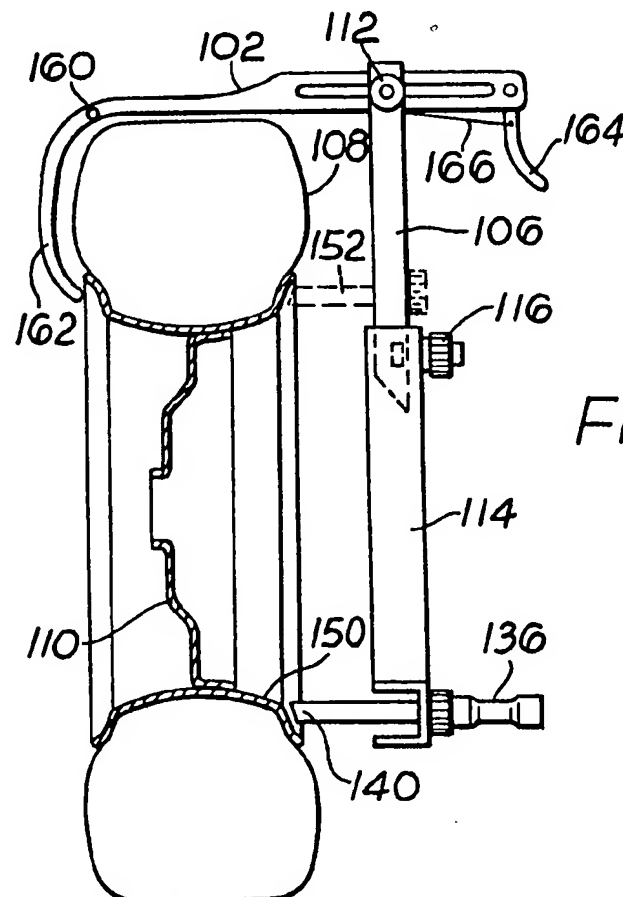


Fig. 2

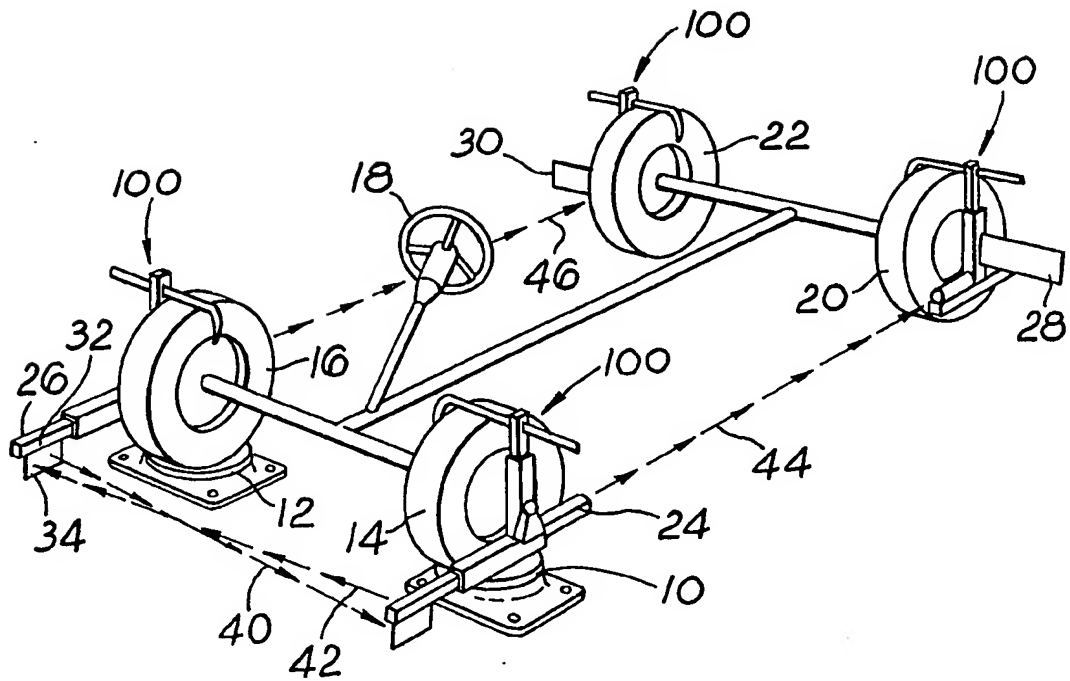


Fig. 1

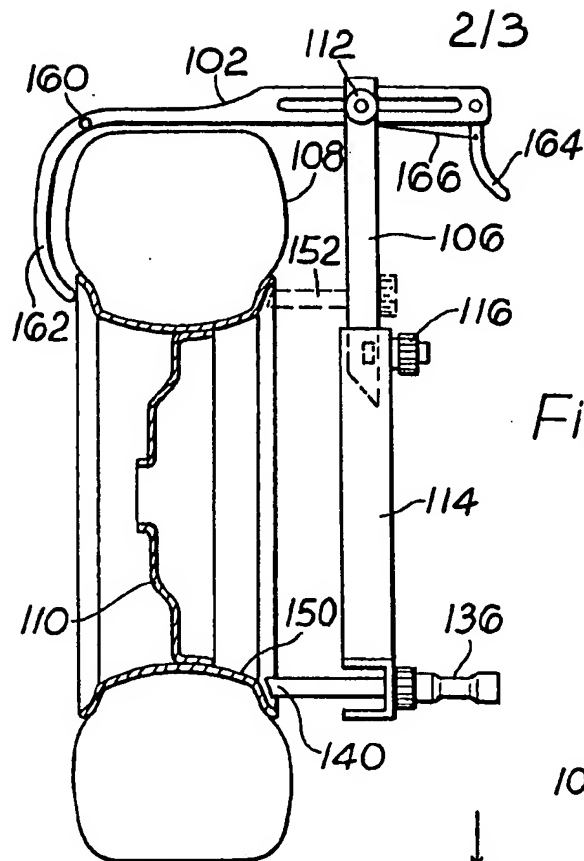


Fig. 2

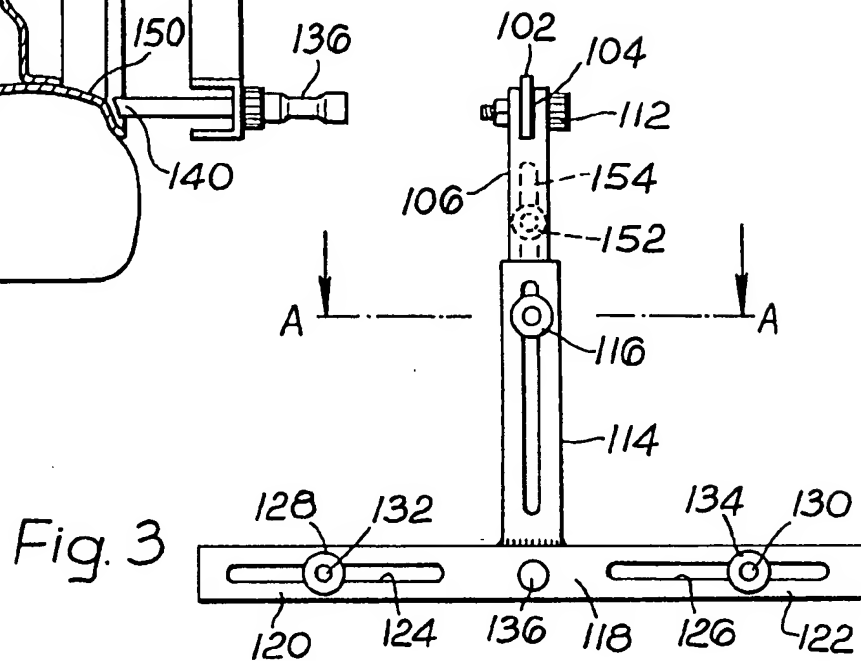


Fig. 3

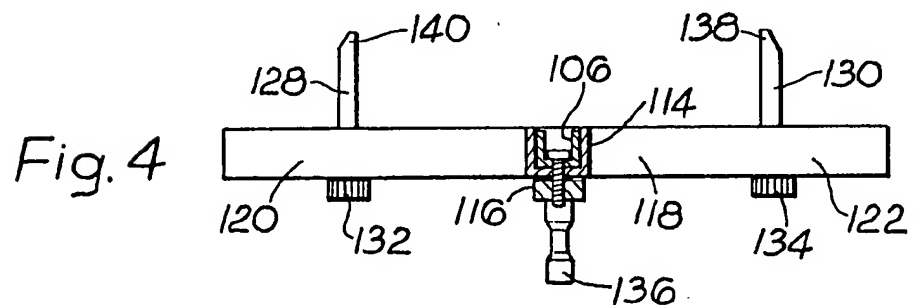
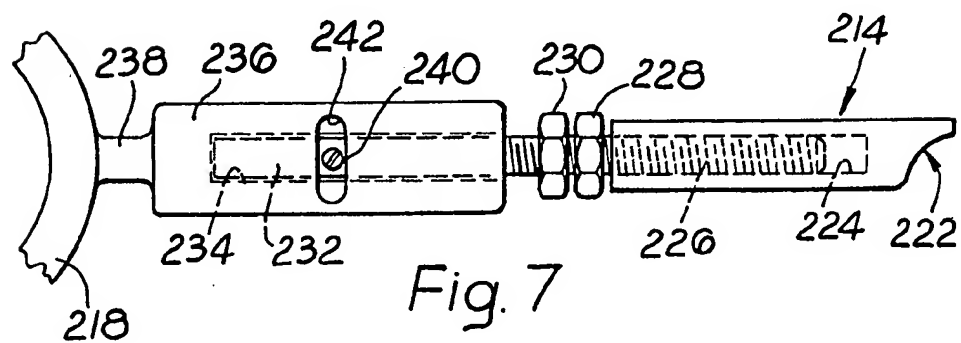
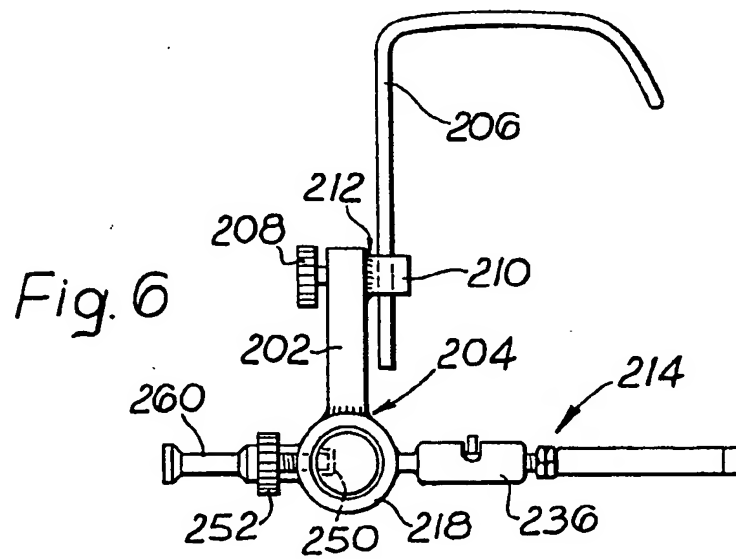
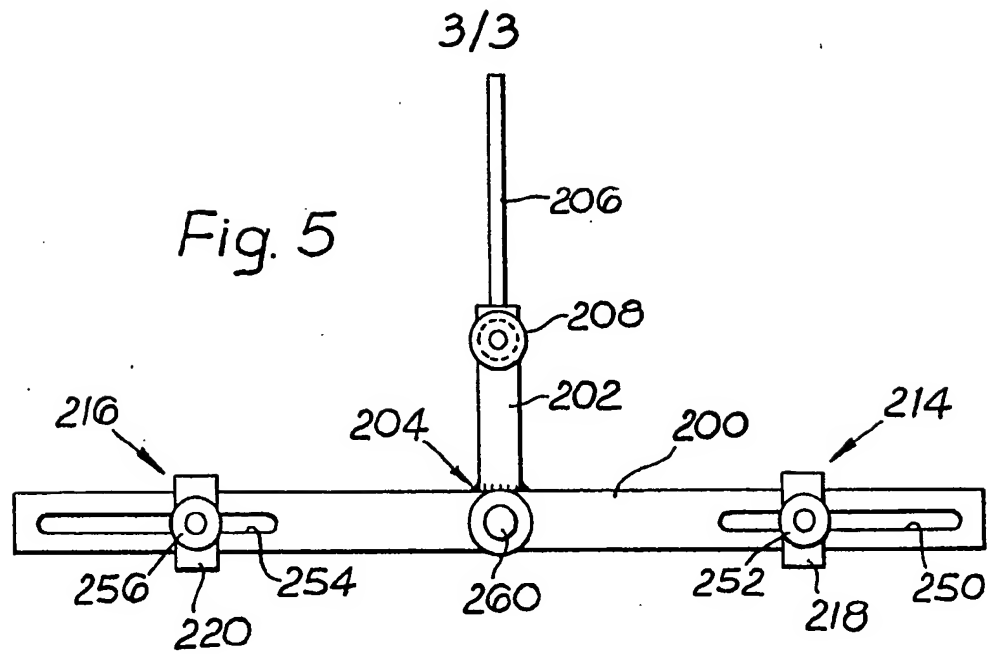


Fig. 4



## SPECIFICATION

### Wheel alignment apparatus

5 The present invention relates to wheel alignment apparatus and more particularly to apparatus for attachment to the wheels of a vehicle for assessing various wheel alignment parameters.

10 A known type of such apparatus comprises a clamp which is equipped with gripping members which are expandable to grip the inside of the rim of a vehicle wheel. Such an apparatus has two disadvantages. Firstly it is difficult and thereby time consuming to fit the apparatus to the vehicle wheel and secondly when the clamp is tightened onto the wheel rim it may damage or at least mark the rim. With the increasing use of alloy wheels the latter disadvantage is becoming an increasing problem.

It is an object of the present invention to provide wheel alignment apparatus which is easily fitted to a wheel and which does not mark or damage the rim during the alignment operation.

According to the present invention there is provided wheel alignment apparatus including a clamp for attachment to the wheel of a vehicle the alignment of which is to be measured in which the clamp comprises hook means for co-operation with the tyre of the vehicle for holding the clamp in relation to the wheel in a first plane and includes spacing means for spacing the clamp apart from the wheel to hold the clamp in relation to the wheel in a second plane.

Preferably the hook means is adjustable to be able to conform to vehicle tyres of varying widths. The clamp means is preferably a single hook member which is slim enough to be insertable between the vehicle tyre and vehicle wing such that the clamp may be positioned with the vehicle in a normal position.

45 In an alternative embodiment the hook may be made collapsible to allow insertion between the vehicle tyre and wing.

The spacing means preferably comprises a pair of pins, each pin being adjustable on a cross member attached to the hook member to alter the distance between the pins, and each pin being provided with a shaped end remote from the cross member such that in operation the shaped ends of the pins are in contact with the rim of the wheel to be aligned.

Preferably the clamp includes an adjustable member which is operative to adjust the distance from the hook means to the spacing means.

In an embodiment in which the apparatus may be used to measure the camber of a wheel, a third pin or third and fourth pins are provided which is adjustable to adjust the distance from the hook means to the spacing means.

wheel to be measured, to provide a three point contact on the rim of the wheel.

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings in which:-

*Figure 1* shows wheel alignment apparatus according to the present invention in position on a four wheeled vehicle;

75 *Figure 2* shows the clamp means of Fig. 1 in greater detail in an elevational side view;

*Figure 3* shows the clamp means of Fig. 1 in greater detail in a front elevation;

80 *Figure 4* shows the clamp means of Figs. 2 and 3 in a cross section plan view along line A-A;

*Figure 5* shows an alternative clamp in side elevation;

85 *Figure 6* shows the clamp of Fig. 5 in end elevation; and

*Figure 7* shows in greater detail a portion of the clamp of Fig. 5.

With reference now to Fig. 1 the wheel alignment apparatus is shown attached to a four wheeled vehicle. For simplicity only the wheels of the vehicle are shown to illustrate the principle.

The apparatus comprises first and second turn tables 10 and 12 on which the front wheels 14, 16 are placed in order that they can turn freely with or without the aid of steering wheel 18. Clamps 100 as shown in greater detail in Figs. 2, 3 and 4 are attached to each of the wheels 14, 16 to each rear wheel 20, 22. The clamps 100 are preferably all substantially identical. At the front wheels alignment apparatus 24, 26 are attached to the clamps as described hereinafter and at the rear wheels reflection apparatus 28, 30 are attached for co-operation with the respective front alignment apparatus.

Each apparatus 24, 26 comprises in known manner respective light beam projection and reflection or chord connection means 32, 34 and 36, 38 (not shown) which projects in known manner light beams 40, 42 or chords which are used to align the front wheels and light beams 44, 46 or chords which are used to check the alignment of the rear and front wheels with respect to each other. Output readings from the apparatus 24, 26 may be fed in known manner to a four wheel alignment computer. Examples of such systems are the HPA 4831 (optical) and HPA 4950 (chord) computerised alignment systems.

The clamps 100 are shown in greater detail in Figs. 2, 3 and 4 to which reference is now made. Each clamp comprises a hook member 102 which is slidable in a slot 104 in a first upright member 106. The hook member 102 may be adjusted to suit the width of a tyre 108 and wheel 110 over which the hook 102 is held in position by

A second upright member 114 is attached to the front member 106 in an adjustable manner as shown and secured thereto by a fixing screw 116 preferably with a large knurled top. To the second member 116 a cross member 118 comprising two arms 120, 122 is attached. Each arm 120, 122 has a respective slot 124, 126 for receiving a turned down screw threaded portion of a respective pin 128, 130. The position of pins 128, 130 may be adjusted, so that the distance between them is varied, by the use of respective knurled nuts 132, 134. A shaped pin 136 is provided for mounting the alignment apparatus 24, 26, 28, 30.

In use the portion 102 is hooked over the tyre and wheel 108, 110 and the screw arrangement 112 is used to adjust the length of the hook portion 102 to the tyre width. The screw arrangement 116 is used to adjust the vertical distance between the hook 102 and the shaped pin 136 so that the axle of pin 136 is in line with the stub axle of the vehicle. The screw arrangements 132, 134 and thereby pins 128, 130 are thereafter adjusted such that the ends 138, 140 of the pins touch the rim 150 of the wheel 110 as shown in Fig. 2.

The ends 138, 140 of pins 128, 130 are shaped such that they at least partially mate with the rim 150 of wheel 110. Thus in the embodiment shown they are provided with tapers.

When the clamps have been attached to the wheels the alignment apparatus 24, 26, 28 and 30 are attached to the clamps.

For the front wheels if it is desired to measure camber a third pin 152 is required. This may be mounted as shown in dotted outline in a slot 154 in upright member 106. For camber measurement all three pins must touch the rim 150 and to achieve this the length of hook member 102 is adjusted until the third pin 152 touches the rim 150. Alternatively third and fourth pins may be provided to provide an additional two point contact for the measurement of camber. These pins (not shown) may, for example, be adjustable on an arm similar to arm 118 but horizontally mounted onto the upright member 106.

The upright members 106 and 114 and the horizontal arms 120, 122 are preferably formed from "U" section to give strength. As can be seen in Fig. 4 the "U" section of member 106 is dimensioned to slide inside the "U" section of upright member 114.

The shape of the ends of the pins 128, 130 can be modified to suit particular types of wheel rims. The apparatus can also be used on wheels now in use in which the rim is very small such that the previously known apparatus can not easily be attached. With suitable choice of pin the apparatus of the present invention can also be used on wheels

can be made to align with or abut the outer edge of the rim. The known apparatus can not be used for this type of rim.

The hook member 102 may be hinged as shown at 160 such that the hook portion 162 may be straightened with respect to the main portion on the hook member 102 to assist in inserting the hook member over the tyre between the tyre and the edge of the front wing of the vehicle. The hinge 160 may be operated, for example, by means of a lever action provided by lever 164 and cable 166.

The apparatus may conveniently be made in two sizes. The first to fit wheel sizes of ten (10) to sixteen (16) inches diameter and the second for wheels of sixteen (16) to twenty four (24) inches diameter. The first size is therefore suitable for cars and light vans and the second or larger commercial vehicles.

With reference now to Figs. 5 to 7 an alternative embodiment is shown comprising a horizontal bar 200 preferably of circular cross-section and a vertical bar 202 also preferably of circular cross-section welded thereto at 204.

A hook-shaped member 206 is adjustably secured to bar 202 by a clamping screw 208 co-operating with a drilled out boss 210 which is preferably welded to bar 202 as shown at 212.

Two members 214, 216 (only 214 shown) are provided to contact the rim or other desired part of the wheel as members 138, 140 (Fig. 4). Each member 214, 216 is mounted on a respective sliding collar 218, 220 in an adjustable manner as now described with reference to member 214 (Figs. 6, 7).

Member 214 has a shaped end 222 and is generally hollow with an internal screw thread 224 which co-operates with a threaded bolt 226. Lock nuts 228, 230 allow adjustment of the effective position of end 222 relative to bar 200 the member 214 being locked in position once calibration has taken place.

The end 232 of bolt 226 remote from the threaded end is inserted in a rotatable manner in a hole 234 in a hollow cylindrical member 236 which is rigidly affixed to collar 218 as shown at 238. The bolt 226 is prevented from removal from hole 234 by a screw 240 which allows a partial rotation by being mounted in a slot 242 in member 236. Rotation of member 214 through 120 degrees or, possibly up to 180 degrees is therefore achievable allowing the ends 222 to conform to the rim or other portion of the wheel.

Collars 218, 220 are adjustable in the horizontal direction by respective slots and adjustment screws 250, 252 and 254, 256.

Referring to Fig. 6 the end of screw 252 fits into slot 250 (shown dotted) and therefore slackening screw 252 allows collar 218 to "relax" around bar 200 thereby allowing adjustment in the horizontal direction. The end

maintains, when screw 252 is tightened the horizontal attitude of members 214, 216.

The clamp is therefore fully adjustable in all directions and allows a boss 260 on which the alignment apparatus (as boss 146 in Figs. 2, 4) is mounted to be positioned at a desired position.

#### CLAIMS

- 10 1. Wheel alignment apparatus including a clamp for attachment to the wheel of a vehicle the alignment of which is to be measured in which the clamp comprises hook means for co-operating with the tyre of the vehicle for holding the clamp in relation to the wheel in a first plane and includes spacing means for spacing the clamp apart from the wheel to hold the clamp in relation to the wheel in a second plane.
- 15 2. Wheel alignment apparatus as claimed in Claim 1 in which the hook means is adjustable to be able to conform to vehicle tyres of varying widths.
- 20 3. Wheel alignment apparatus as claimed in Claim 1 or Claim 2 in which the clamp means is a single hook member which is slim enough to be insertable between the vehicle tyre and vehicle wing such that the clamp may be positioned with the vehicle in a normal position.
- 25 4. Wheel alignment apparatus as claimed in Claim 1 or Claim 2 in which the hook is collapsible to allow insertion between the vehicle tyre and wing.
- 30 5. Wheel alignment apparatus as claimed in any one of Claims 1 to 4 in which the spacing means preferably comprises a pair of pins, each pin being adjustable on a cross member attached to the hook member to alter the distance between the pins, and each pin being provided with a shaped end remote from the cross member such that in operation the shaped ends of the pins are in contact with the rim of the wheel to be aligned.
- 35 6. Wheel alignment apparatus as claimed in Claim 5 in which the clamp includes an adjustable member which is operative to adjust the distance from the hook means to the spacing means.
- 40 7. Wheel alignment apparatus as claimed in any one of Claims 1 to 6 modified to measure the camber of a wheel, in which a third pin or third and fourth pins are provided which is adjustable with respect to the first two pins to contact the rim of a wheel to be measured, to provide a three point contact on the rim of the wheel.
- 45 8. Wheel alignment apparatus substantially as described with reference to Figs. 1 to 4 or Figs. 1 and 5 to 7 of the accompanying drawings.
- 50 60